emerged in the pot containing pupae of *zonaria*. The larva must have been placed there by mistake. This female was ovipositing between the flower pot and the leno cover. There had been *zonaria* males in the pot with the female *hispidaria*, but I am quite sure there had been no male *hispidaria*, for all of them had been killed before the end of January. No pairing between a male *zonaria* and the female *hispidaria* was seen."

From this account there can be little doubt that the reputed hybrids are parthenogenetic specimens of *Apocheima hispidaria* and it is not unlikely that a pairing with a male *zonaria* did take place and that the foreign sperm stimulated the development of the eggs. On the other hand it may be a simple case of parthenogenesis, though it is a rare phenomenon in the *Geometridae* and no example of it occurring in this species is given by Tutt.

THE SUMMER FLIGHT, IN COLD CLIMATES, OF VERNAL AND AUTUMNAL LEPIDOPTERA.

By E. P. Wiltshire, F.R.E.S.

My previous paper, "Notes on the winter flight, in mild climates, of vernal and autumnal moths" (*Ent. Rec.*, 15.xi.1938), drew attention to the convergence and overlapping of the time of flight, in Syria and Palestine, of certain moths whose time of flight in more strenuous climes was separated by winter. The converse phenomenon, that is, the convergence of the time of flight, in northerly latitudes or at high elevations further south in the Palaearctic zone, of species whose time of flight elsewhere is separated by high summer, can also be remarked, though the overlapping is in most of these cases less complete. Early August is the "separating season" for this second phenomenon, just as late January is the "separating" time of the species mentioned in the first article, where they do not overlap. Phenological tables, drawn up on the analogy of the previous table, illustrate this tendency.

I here regard as vernal not only the very vernal species, which both aestivate and hibernate in the pupal stage (e.g., *C. verbasci*, *D. areola*, *S. dentinosa*), but also the numerous early summer insects whose larvae hibernate; and as autumnal, not only those that pass the winter in the egg stage, but also the late summer species whose larvae hibernate. I do so because the high summer's heat, in warm climates, may be as important an obstacle in the life-cycle as winter's cold in other climates; the fact that a species prefers to fly well before or well after early August puts it in quite a different class from those that appear, in spite of the heat, exactly at the hottest part of the summer (a small class) or those which appear in successive broods throughout the summer (a more numerous class). These two classes alone really deserve the name "summer insects," and most single-brooded insects can without difficulty be divided into vernal or autumnal from a knowledge of their time of flight throughout their range. The species discussed in this and the previous article are all single-brooded.

The species considered in the tables are:—*Aporia crataegi*, L., *Malacosoma castrensis*, L. (Europe) and *castrensis-kirghisica*, Stgr. (Iran), *Lacydes semiramis*, Stgr., *Volgarctia spectabilis*, Tausch, *Thaumetopoea*

pityocampa, Schiff. and *wilkinsoni*, Tams, *Simyra dentinosa*, Frr., *Agrotis forficula*, Ev. and *elbursica*, Drdt., *Rhyacia nyctymerina*, Stgr. (ssp. *roseoflava*, Cti. in Syria, ssp. *rehnensis*, Wagn., in Iran), *Cucullia verbasci*, L., *Phragmitiphila typhae*, Thnbg., *Phragmatoecia castaneae*, and *Phragmatoecia territa*, Stgr.

In the tables, closely-related species or subspecies of the same species are, for the sake of brevity and also to illuminate the comparison, included under one name.

PHENOLOGICAL TABLES, illustrating article on The Summer Flight, in Cold Climates, of Vernal and Autumnal Lepidoptera.

HOT.

	Mesopotamia, below 3300 ft. (Lat. 31-37 N.).	Lebanon, below 4000 ft. (Lat. 34 N.).	Farsistan, 5000-7000 ft. (Lat. 30 N.).
crataegi	—	—	IV-V
castrensis	—	—	V
semiramis	—	—	28.IV-V
spectabilis	—	—	IX-X
Thaumetopoea	—	X	—
dentinosa	—	IV	IV
forficula	V	V-VI	IV-V
elbursica	—	—	V-VI
nyctymerina	—	—	V ?
verbasci	—	III*	?
typhae	VI	VI-VII	VII
castaneae	IV	—	?
territa	—	—	IX

COLD

	Lebanon Mts. (6000-7000 ft.) (Lat. 34 N.).	Kurdish Mts. (4000-6000 ft.) (Lat. 37 N.).	Mt. Alvand (8000-10,000 ft.) (Lat. 35 N.).	Barfkhaneh (10,000-12,000 ft.) (Lat. 32 N.).	Elburz Range (7000-12,000 ft.) (Lat. 36 N.).	Europe Lat. 50-55 N.).
crataegi	V-VI	V	VI	?	V-VII	VI
castrensis	—	?	?	?	VII	VII-VIII
semiramis	—	?	VI-VII	VI	VI-VII	—
spectabilis	—	IX	?	?	VIII-IX	—
Thaumetopoea	4.VIII	—	—	—	—	VII-VIII
dentinosa	V	?	—	V-VI	?	—
forficula	VI-VII	VI-VII	VI-VII	VI	V-VII	—
elbursica	—	?	?	?	VII-VIII	—
nyctymerina	VII-VIII	?	VI-VII	VI	V-VII	—
verbasci	IV-V*	?	?	?	V*	IV-V
typhae	?	?	—	—	?	VIII-IX
castaneae	—	—	—	—	?	VI-VII
territa	—	?	VII	?	VII	—

*Times of wild emergence calculated from wild larva's size.

Under the heading " Mesopotamia " are included records both from the plains and the lower Zagros hills. Mt. Alvand and the Barfkhaneh (near Yezd) are both high Persian peaks; the latter has only received one visit, in early June, while the former has only been worked in June and July. The other localities in the tables have been the subject of longer attention.

Most of the biological facts in this article and most of the dates given in the tables are from my own records, but some are taken from stock reference books such as South and Blaschke, or from recently published works by other authors, such as Schwingenschuss's *Beitrag zur Lepidopterenfauna von Iran (Ent. Zeit.*, J., 52-53, Nos. 46 ff).

In the first table (the hotter localities) the respective times of flight of vernal and autumnal species are well separated; the tendency to overlap may be traced in the remaining columns, the colder localities.

In general, the first table clearly indicates whether a species is vernal or autumnal, the notable exception being *typhae*, which has a marked vernal tendency in hot climes. In briefly considering this case in my previous article I suggested that the oval hibernation, being unnecessary in a hot climate, suggested *typhae*'s having originated in a cold climate; I still consider this argument sound, and regard *typhae* as normally an autumnal species. The other autumnal species on our list do not occur at all in northern latitudes, and are far less stenoecous than *typhae*, which in hot climes is only to be found along perennial streams and springs. With *typhae* must be classed the other *Archanaras* which react in the same way to hot climates (*geminipuncta* and *sparganii*). *Castaneae*, on the other hand, is known to take two years to mature in cold climates, and is evidently not in the same class; it may be regarded as vernal, in contrast to its congener *territa*. (I should perhaps here mention, in view of Schwingenschuss's record of the presence of reeds at one of *territa*'s Elburz habitats, that this moth flies in profusion high up on mountains in Persia, where there is no sign of any *Phragmites*-growth).

Are there any other cases where speculation is profitable as to the possible place of origin of the species, or at least the sort of climate in which their specific characteristics crystallised? Does a study of the time of flight and life-history of other species beside *typhae* shed any light on such a hazardous question? In the previous article I suggested that the pupal or larval aestivation of autumnal species whose larvae hibernate, being unnecessary in colder climes, suggested a southern or warm climate origin, such species being the *Amathes*, *Aporophyla* and *Ocnogyna* species named in that article. To them we may now add *spectabilis* and (probably) *territa* (whose early stages are not yet known) and the pine-feeding *Thaumetopoea* group. In this last case, the fact that *pityocampa* sometimes in Europe fails to emerge from the pupa till the following year is surely an expression of the group's ingrained habit of pupal aestivation, such as occurs in a more normal way in *wilkinsoni*. The previous article also suggested a warm climate origin, on account of their pupal aestivation in England, for the vernal *anthemis*-feeding *Cucullia* group. As for *castaneae*, which, as already stated, takes two years to develop in N. Europe, we may conclude that it originated in a warmer climate if we regard the annual cycle as the norm in lepidoptera in cool climates. There is not room, however, here to discuss

the mullein-feeding *Cucullia* group or the case of *castrensis*, whose egg overwinters in Europe and also (presumably) in Persia; a confident inference of their origin seems impossible. There remain a number of species of more restricted range which, not occurring in very different climates, offer no chance of comparison in their reactions to local climate; for these, therefore, also no suggestion, based on the above criteria, is here offered as to their origin; we should, however, probably not go far wrong in postulating for *territa*, *semiramis*, *spectabilis*, *elbursica*, *forficula*, *nyctymerina*, and *dentinosa* an origin on the steppe mountains of Anatolia and Iran, beyond which their range does not extend very far. Such a postulation, however, will rest on zoogeographical grounds.

It is indeed interesting to compare the guesses made above on the basis of biological and phenological criteria with the zoogeographical classification of the same species. For instance, the vast range of *castaneae* puts it almost in the Geopolitan category; it seems to be a primitive species of great adaptability that originated in a tropical or semi-tropical climate.

LARVAL HABITATS OF APATURA IRIS.

By A. J. Wightman, F.R.E.S.

Having been officially requested, in common with the rest of the public, to keep off the roads on Easter Monday last, I abandoned a projected trip to Kent for pupae of *A. cinerea* and found myself at a dead end in my home locality, with a whole day in front of me.

I had for several years intended, when the time and mood should be upon me, to try and find just how widespread and plentiful *A. iris* was around this area. Occasionally, when beating for other things, I have found the larva of *iris* on the sheet, but always singly (and the idea being at the moment in mind, as a result of finding a small larva of the species among sallow catkins I had taken for larvae of *Xanthia fulvago*), I spent the day among the sallows in the woods. I used a car to get from one place to another and so covered a considerable area, sampling rather than searching each selected locality.

I had been advised to ignore sallows in open and dry situations and so spent most time in damp and narrow rides in rather heavily wooded country.

I worked only large-leaf sallows, not because all the " books " say this is the right thing to do, but because those of the small-leaf varieties, in common with all the foliage around, had been stripped by thousands, probably millions, of larvae of Geometers, Noctuae, and Micros. It was May, but most trees and shrubs were as bare as in midwinter. I have never seen such devastation before.

I first searched the selected bushes and then beat them and in this way had taken several half-fed *iris* larvae, widely separated from each other, when I chanced upon an old stone quarry, in which there was a large tree-like sallow, the branches of which were 20 feet from the ground and out of reach except at one spot, where a high mound of earth made it possible to clamber up and hook down a single fair-sized branch.